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Case: USA v. Crumpton
Case ID #: 192B-AT-3410734

Historical Cellular Analysis Report

We have reviewed the records for cell phone number (215) 807-9708 (AT&T), allegedly utilized by Mr. Crumpton on March 19, 2021.

Two objections to the courtroom evidence presented must be raised, viz.:

- The CDR records are too imprecise for the location of cell phone handset to be of substantive value in the courtroom.

- The NELOS records presented contain numerous errors which render them unreliable and non-credible as a source of location information for the given cell phone number.

Call Detail Records

CDRs (Call Detail Records) consist of voice calls, SMS (Short Message Service = text messages), and MMS data (Multi-Media Service = pictures, songs, or videos/films) events initiated by the cell phone subscriber or received by him. These records specify the cell tower/site which serviced the call and frequently the sector/face. Thus, the cell site location and a gross directionality can be inferred for the location of cell phone handset origin.

Imprecision of Phone Handset Location

Call Detail Records are too imprecise for location of cell phone handset to be of substantive value in the courtroom, and thus are not helpful to the tier of evidence. The location of the cell site/tower is routinely conflated as the location of the cell phone handset, when in truth, the individual phone handset can be anywhere from zero to 21+ miles from its serving cell tower. [FN1] This comprises a vast area, in excess of 1500 square miles, [FN2] for the originating point of a cell phone connection. For comparison, the area of Rhode Island, our smallest state, is quoted as 1545 square miles in one instance.

Even if the cell site sector is known and there are three sector faces, we still have a very vast area of, nominally, 500+ square miles of ambiguity for originating location of cell phone handset.

In court, maps are shown with cell tower usage near the crime scene which give the false impression the cell phone is also near the crime scene; however, no scientific principle of radio waves compels this impression. The renowned Professor Edward J. Imwinkelried writes: [FN3]

> The validity of the science of radio waves does not dictate the conclusion that the cell identification technique is valid. Moreover, even positing the validity of the cell identification technique, a trial judge should not permit an expert, relying on this technique, to opine that the caller was at a specific location at the time of the call. At most, the proper use of the cell identification technique enables the expert to conclude that the caller was within a more or less large geographic area at the time of the call.

Given the imprecision and ambiguity of origin location of a cell phone handset, CDR records are of dubious value in the courtroom. We dare not conflate the known cell site location with the unknown cell phone handset location, for this could lead to cases of grave injustice.

Network Event Location System Records (NELOS)

NELOS records are random time measurements made by the cellular provider to monitor the health and efficiency of the network. These records are based on a round trip delay (RTD) principle, which effectively sends a response command to the cell phone handset and records the time interval the response is received. It is analogous to a RADAR system tracking the approach of an aircraft. The time interval is divided by two and multiplied by the speed of light, some 186,282 miles per second to calculate the distance between tower and the phone handset's location.

NELOS Records Are in Error

Regarding NELOS records, AT&T, the instance cellular provider publishes:

Historical Precision Location Information Disclaimer:

The results provided are AT&T's best estimate of the location of the target number. Please exercise caution in using these records for investigative purposes as location data is sourced from various databases which may cause location results to be less than exact.

Unfortunately, the data set presented, ReportLoc_3395757.pdf, has numerous errors and inconsistencies. Some 39,951 records are presented and in 7,080 instances the cell phone handset is moving at a calculated speed exceeding 90 mph. This is an improbable speed in an urban environment and is counted as an error.

Some dramatic error examples from the relevant date, 3/19/21, before and after will illustrate the problem:

Error example 1 from 3/19/2021:

We observe, that at item 39873, with time stamp 11:14:17 the cell phone handset is at GPS location 33.916572, -83.399427 and some 6 seconds later the handset is at location 33.919029, -83.38203, having moved 1.0129 miles at an improbable speed of 607.74 miles/hour.

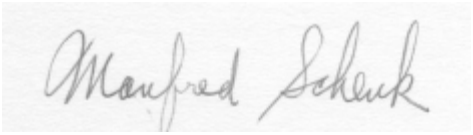
Error example 2 from 3/9/2021:

Similarly, at item 39920, with time stamp 07:01:30 the cell phone handset is at 33.94395, -83.746719, some 5 seconds later the handset is at 33.939774, -83.721312 having moved 1.486 miles, at the improbable speed of 1070.09 miles/hour.

Error example 3 from 5/19/2021:

Also, at item 37368, with time stamp 07:55:10 the cell phone handset is located at 33.916572, -83.399427, some 3 seconds later the handset is at 33.919029, -83.38203 having moved 1.0129 miles at the improbable speed of 1215.49 miles/hour.

Given these three examples of 7,080 improbabilities discovered, plus AT&T's own disclaimer make these AT&T location records problematic as courtroom evidence, because the errors and inconsistencies render them unreliable and non-credible as a source of location information for the given cell phone number.



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Manfred Schenk

[FN1] NIST Special Publication 800-101 Revision 1, Guidelines on Mobile Device Forensics, May 2014, page 54, paragraph 2.

[FN2] Within TDMA (Time Division Multiple Access} technology time is divided into 64 discrete units of Timing Advance. Each unit represents 550 meters of distance that the Radio Frequency (RF) signal travels. Thus 550 times 64 equals 35,200 meters or 35+ kilometers equal to 21.87 miles. The Euclidian geometry formula for the area of a circle is $A=\pi*r^2$. Thus radius 21.87 miles squared times 3.14 (pi) equals 1503+ square miles.

[FN3] Criminal Law Bulletin, Summer 2013, Volume 49, Issue 3, The Use of Global Positioning (GPS) and Cell Tower Evidence to Establish a Person's Location — Part II, Page 10.